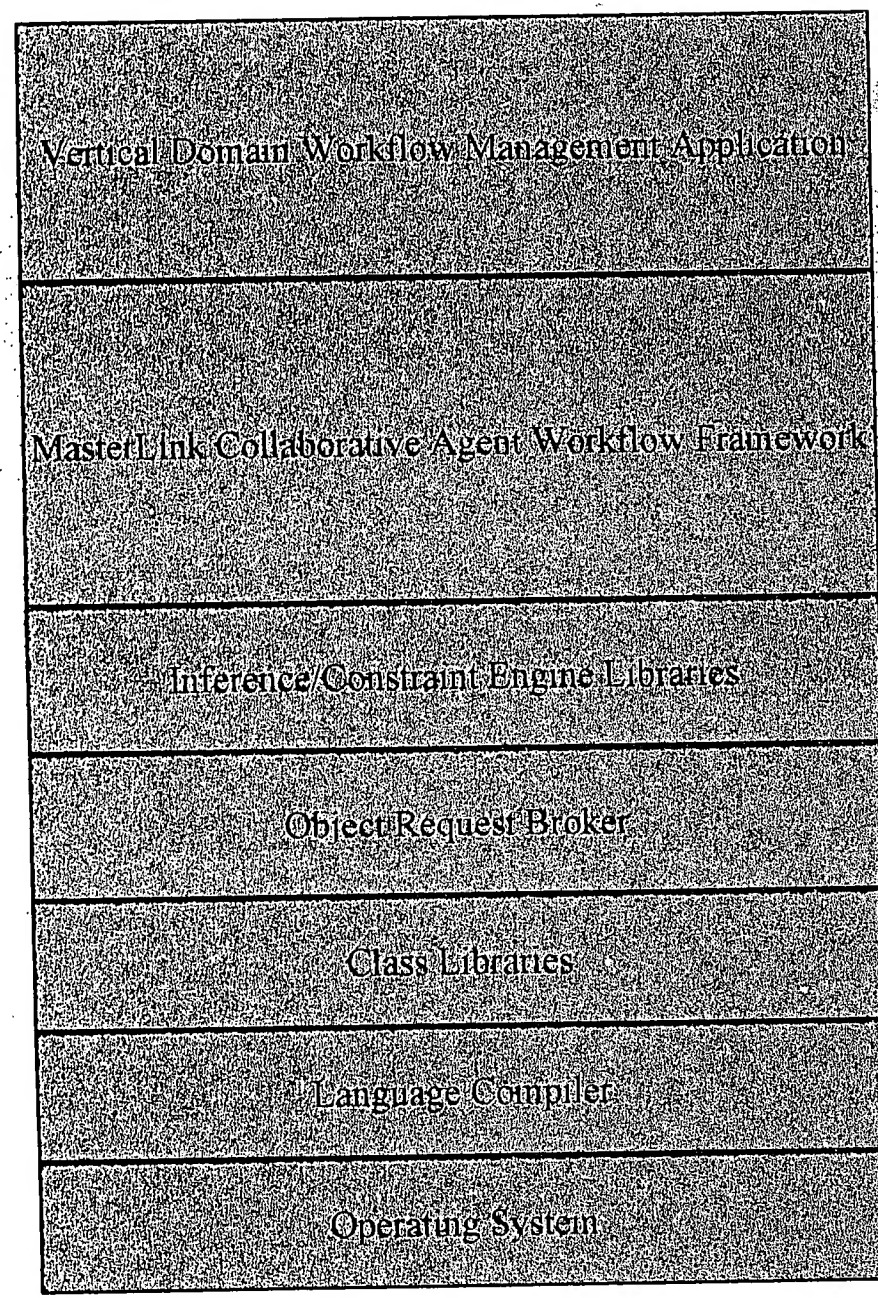
Physical Architecture for a Distributed Workflow Management System



The domain specific objects involved in a physical implementation of a workflow management application based on the MasterLink framework. This includes such things as work management policy objectives, work targets in a classification heirarchy, rules for MasterLink agents, task definitions, job types, job state transitions, and work schedule state transitions. These are specified on a case by case basis, e.g. for a facilities maintenance domain, a home health care domain, or an aircraft maintenance domain.

The MasterLink collaborative agents, and the framework of classes supporting these agents which provide the basis for a workflow management application to be built. The relationships between the domain specific objects referred to above and the workflow management agents are defined in this framework. It is the generic representation of a workflow management solution which is the basis for any domain specific implementation to be built.

The MasterLink agents are implemented as classes that are derived from commercially marketed artificial intelligence products. The ability of a MasterLink agent to use a set of rules or constraints to make a workflow management decision is based on this technology.

The mechanism by which distributed instances of application objects can send messages to each other. The support for these distributed objects to communicate over a wireless connection is evolving. Until mature, existing wireless protocols may have to be implemented.

Depending on the language, these are commercially available libraries for common programming functions, such as file i/o, directory services, string handling, date/time functions, and database connectivity.

The programming language used to implement the application. At this point in time the distributed object oriented options include C++ and Java. This is due to the compatibility requirement with the AI products, Orbs and Databases.

The operating system which must be capable of supporting the language and other off the shelf components mentioned above. Typically this is Unix or NT on servers, and clients will vary depending on their type, e.g. a desktop LAN connected client versus a handheld wireless network device.

Exhibit 3A

A-TEK Consultants, Inc.

CONTRACT SERVICES
PROJECT MANAGEMENT
PERMANENT PLACEMENT

April 21, 1997

Mr. Gregory A. Howard
Business Development Manager
Lockheed Martin Information Systems
12506 Lake Underhill Road, MP 830
Orlando, FL 32825-5002

Dear Greg:

Here is Garry Fenimore's rendering summarizing the problems in CMMS as promised. He would be glad to cover in detail why we are different if you wish at our next meeting. This is an excerpt from our initial white paper which of course has been evolving.

Very truly yours,

Kent A. Weisner
President

Encl.

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State of the Art - Current Systems

Work Function	Current Approach	Deficiencies	MasterLink Approach
System Initiation	Users are forced to create entire numbering and/or coding schema in order to define basic facility information requirements, for example: * equipment grouping/ relationship * skill definitions * task/time/skill requirements	This requirement may consume hundreds of manhours to produce, very difficult to maintain, and is error-prone. Definitions become proprietary to the operator and dependent on his/her facility philosophy. Also, the methodology used by that staff person may not be able to accommodate future enterprise changes.	MasterLink **Reduces Implementation Costs** by assuming that all facilities are defined by existing architectural standards. These standards are pre-defined in an intelligent, **Standardized Database Infrastructure**. The user may create **Industry Specific** equipment combinations, but the system logic remains intact.
Work Reception	Clerk generates hardcopy workorder (w.o.) & hand delivers to planner	The clerk, usually not a maintenance technician, cannot fully classify work.	Work requestors interface with MasterLink electronically through their company computer network. The expert database prompts the caller to answer questions to determine need.
Work Planning	Planner subjectively defines job requirements for: * task definitions * skills * material * time to complete (estimate)	Planning is only as good as the planner on staff. There is no verifiable method to determine if the optimal combination of resources are being used.	MasterLink responds to each call by predefining **Work Standards**, i.e., the tasks, skills, material, and time required. That data is cross-referenced against actual performance data to select the best available personnel, thereby enabling staff **Skill Optimization**.
Work Scheduling	Scheduler manually manages backlog, tries to distribute work evenly.	Very difficult to react to changing work load.	MasterLink manages backlog automatically using **Real Time Information**, adjusts to changing conditions "on the fly" , enabling superior **Resource Leveling Capabilities**.

State of the Art - Current Systems

Work Function	Current Approach	Deficiencies	MasterLink Approach
Work Dispatch	Scheduler manually distributes hardcopy of workorder to maintenance technician.	Maintenance workers are often unavailable to receive hardcopy. Consequently, they must document their work "after the fact" which promotes incomplete data gathering.	MasterLink enables the scheduler to dispatch work requirements electronically, including Diagramming and Advanced Graphics information. Worker data is always current.
Work Execution	Worker arrives at the work site to complete the assigned task.	If any support documentation is required worker must return to base or ask for assistance.	Worker is supplied ALL Work Point Information needed to complete the assignment at the handheld terminal device. Worker Productivity is improved by eliminating non-productive searches for support data.
Work Closure	Worker returns hardcopy of workorder to receptionist who records closure data on material, crew, and time.	The ONLY method of data capture is manual entry which very often does not describe what was actually accomplished.	Worker presses a function key to record all information electronically, and completely. Management Effectiveness is maximized with availability of accurate job data.
Quality Control	The worker is relied upon to do the job he/she was dispatched to do.	No method of verifying attendance, or tasks actually completed.	Worker Accountability is improved by verifying attendance, and prompting the worker to record all tasks done on the handheld field unit.
Management Information	Reports are constructed from data that is often more than a few days old.	Information provided is unsophisticated, incomplete, and not current.	Provides real-time data and statistical data to make mature business decisions, resulting in Improved Worker Morale because the organization is more productive.

Conclusion:
MasterLink optimizes resources by enhancing availability and use of facilities, accelerating and increasing work results, while improving Return On Investment for facility owners and operators, and by reducing CMMS Ownership Costs.

A-TEK Consultants, Inc.

CONTRACT SERVICES
PROJECT MANAGEMENT
PERMANENT PLACEMENT

Sent via fax: 306-2641

CONFIDENTIAL

April 30, 1997

Mr. Gregory A. Howard
Business Development Manager
Lockheed Martin Information Systems
12506 Lake Underhill Road, MP 830
Orlando, FL 32825-5002

RE: MasterLink© Presentation

Dear Greg:

As requested: Job State Transitions Slide (see attached).

Adding to what we have already presented is inclusion of the thin client concept in our technical architecture plan. Thin client browser based interfaces to server allows corporations to go back to putting something inexpensive (affordable) on the desk or in the hand for needed information transfer and increased productivity. We would appreciate your sharing this additional information with Mr. Gary Mann. This should merit his attention. Could he join us for the meeting next week? We will wait to hear from you as both John Hartman and Gary Fenimore must make travel plans. Friday at 3:30 p.m. would be preferred by us.

Very truly yours,

Kent A. Weisner
President

Encl.

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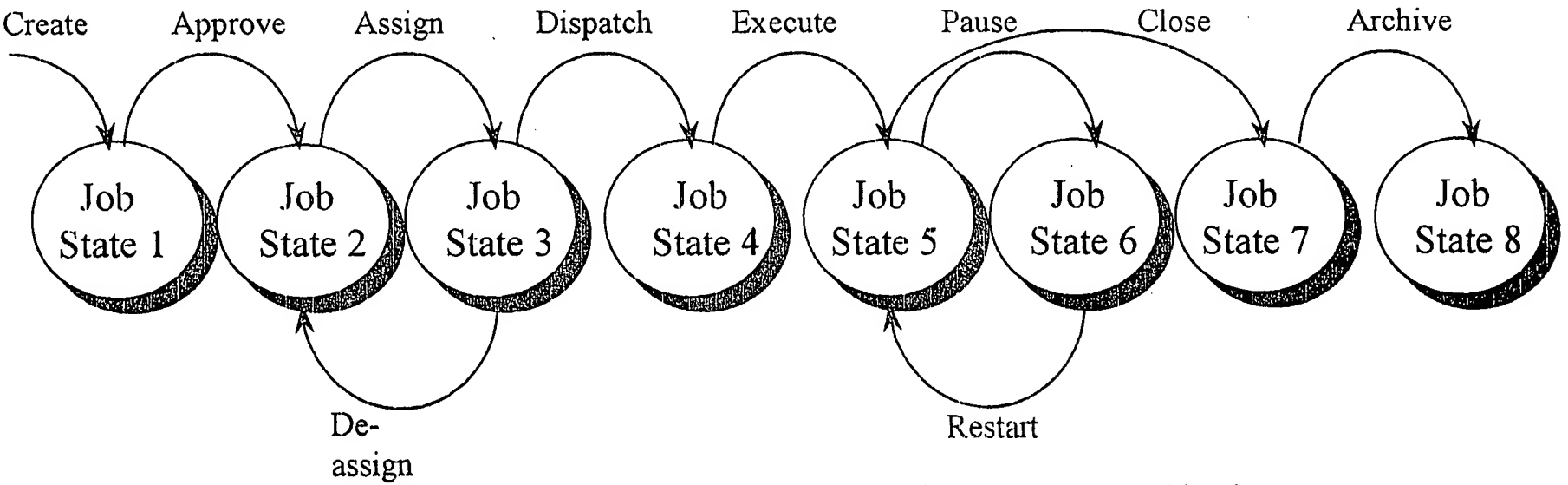
JOB STATE TRANSITIONS

Example Job Type



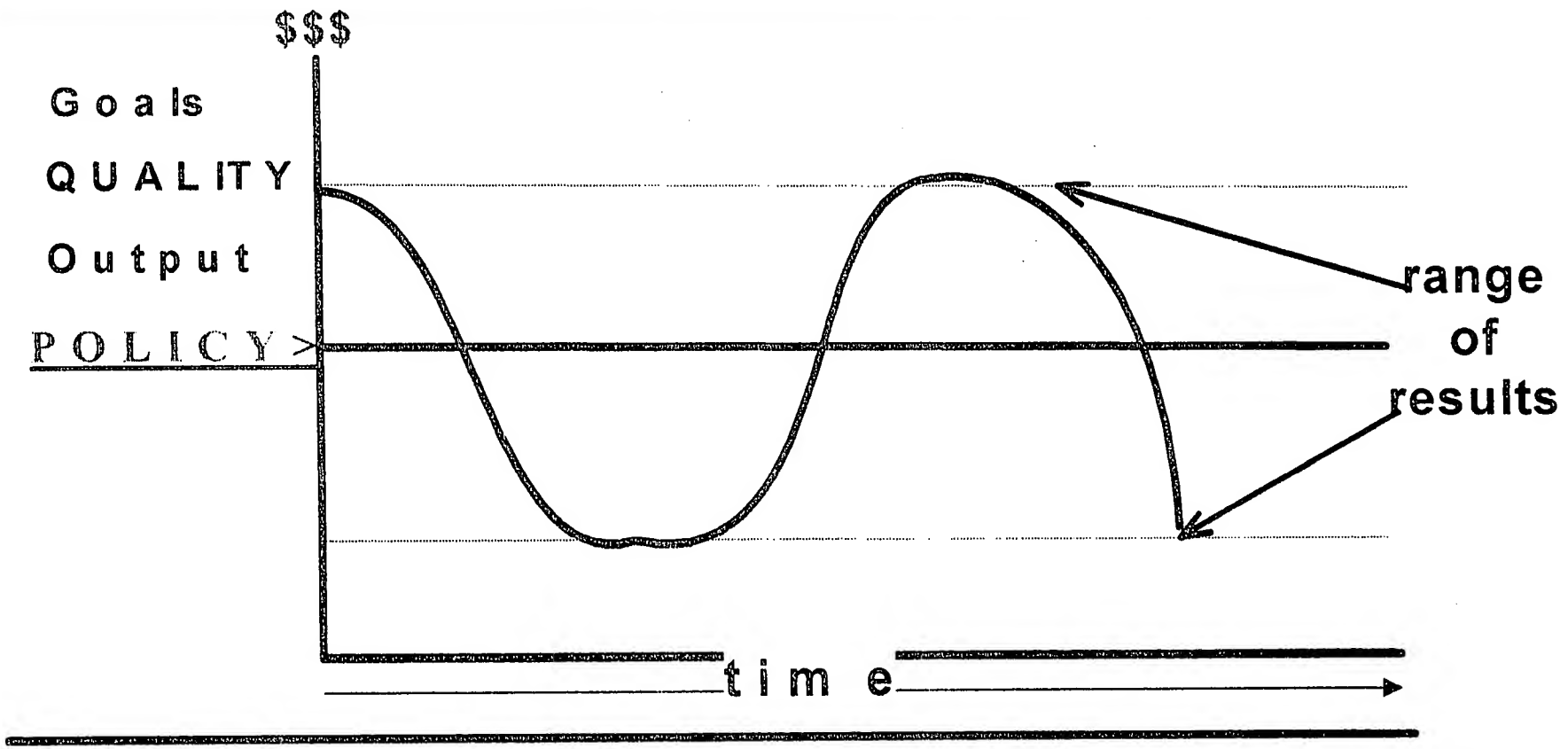
- A series of states and transitions will be defined for each "type" of job to be managed by the system.
- A set of businsess rules governing each possible transition will be determined. Analysis will include consideration for vertical domain classes.
- System agents will use sets of rules to automate selected transitions. External interfaces will support manual transitions and overrides.
- "Planner" agent will address the generation or creation of jobs containing planned tasks.
- "Scheduler" agent will address the assignment of jobs to resources and time.
- "Dispatcher" agent will handle delivery of work schedules to resources.
- The worker, through a mobile device interface, will be the source for many transitions.
- "Job Manager" agent will act as a communications traffic cop receiving messages, representing events, from the external interfaces (either GUI or system based) , from the internal system agents, and from other MasterLink internal classes.

Work Process Specifications are:

- Methods of Actions
- Selected From Alternatives
- Based on Results
- Constantly Changing

MGMT SYSTEM DOMAIN

Classic Work-process



What Is MasterLink?

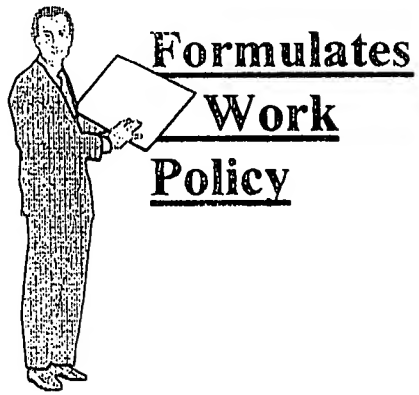
It is An Event-driven Tool Used to:

- **Integrate Work Technologies**
- **Automate Supervision**
- **Link Actions to Specifications**
- **Track Performance**

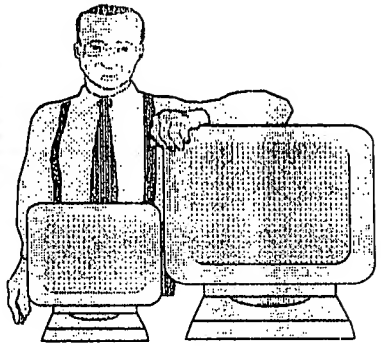
◆ Data-centric Process Management

① Management

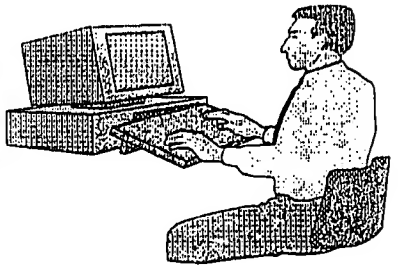
Formulates Work Policy



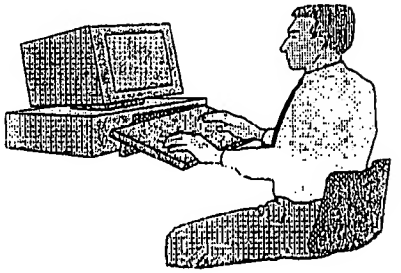
② Supervisor



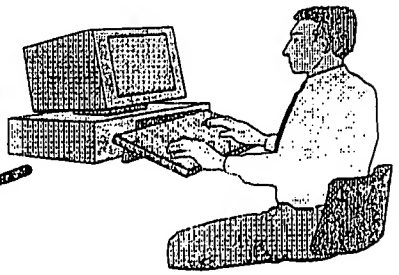
③ Planner



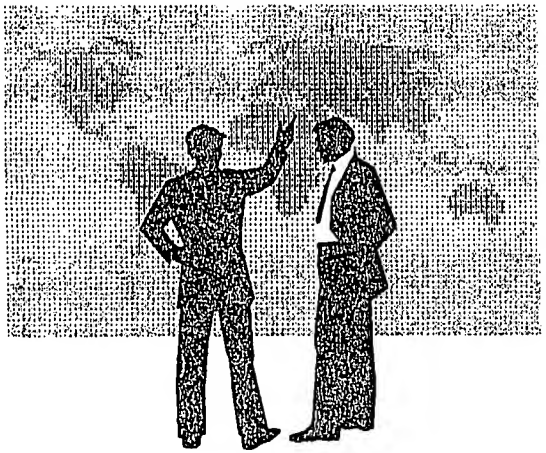
④ Scheduler



⑤ Dispatcher

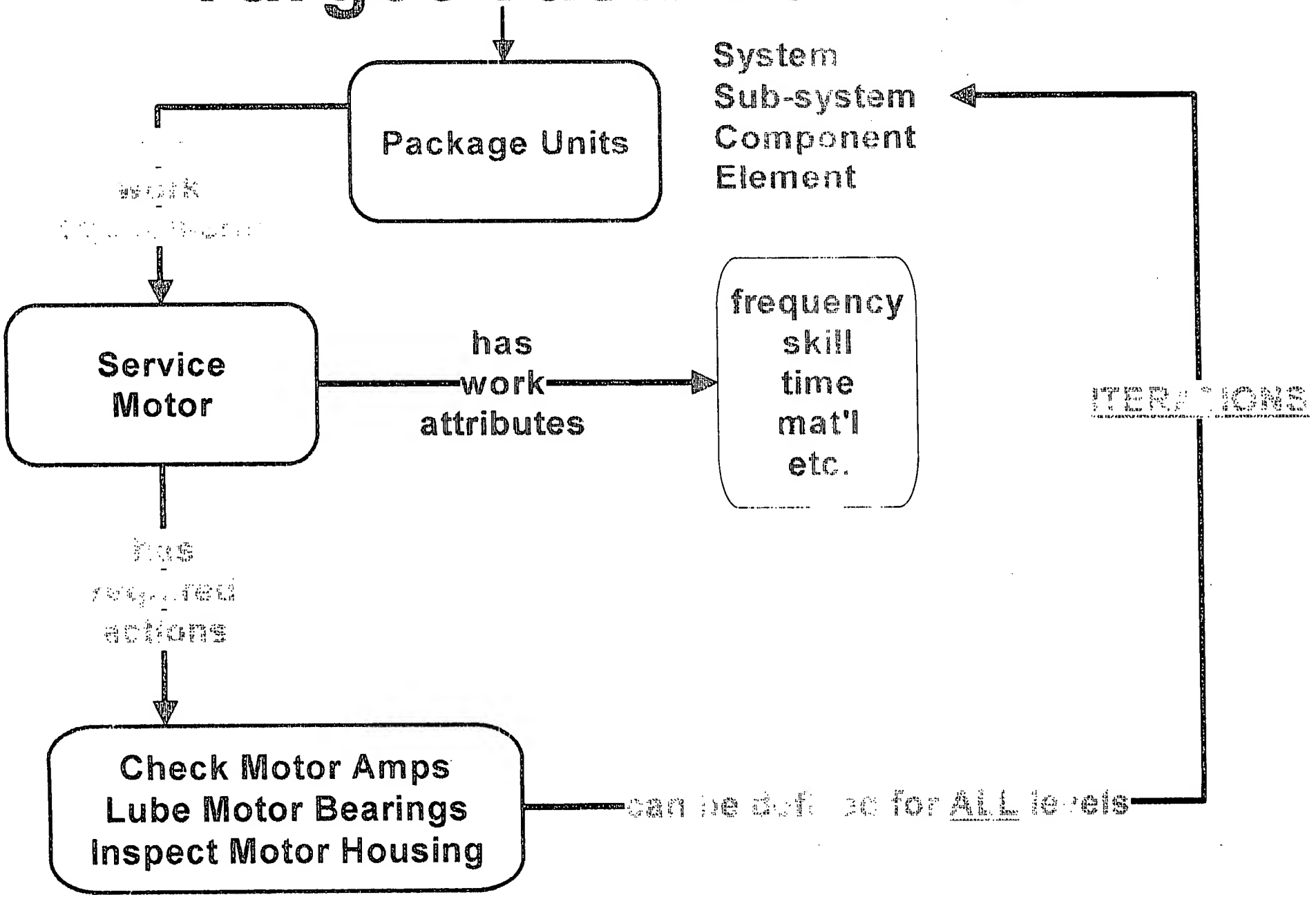


⑥ Technician

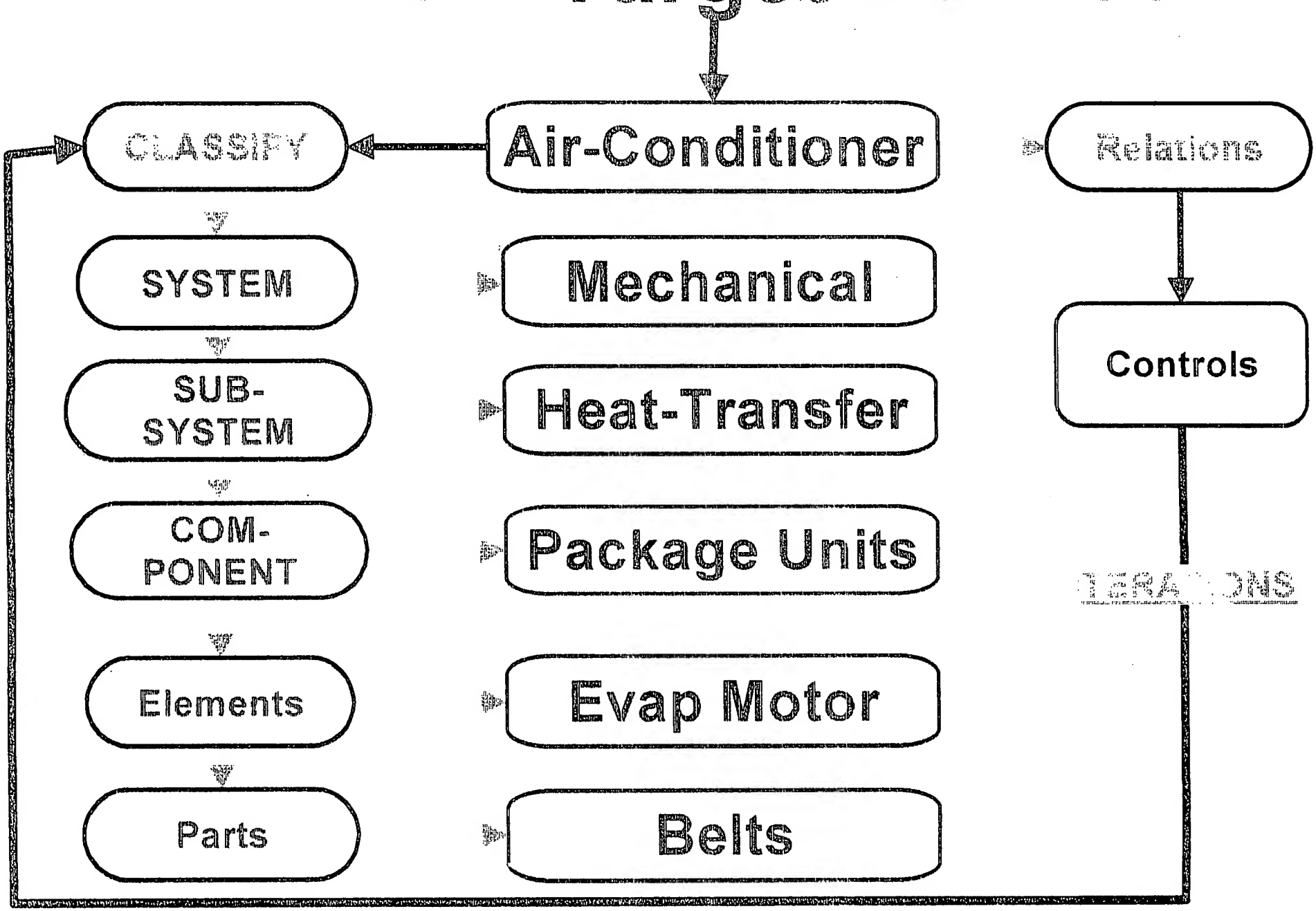


⑦ CUSTOME R is Served

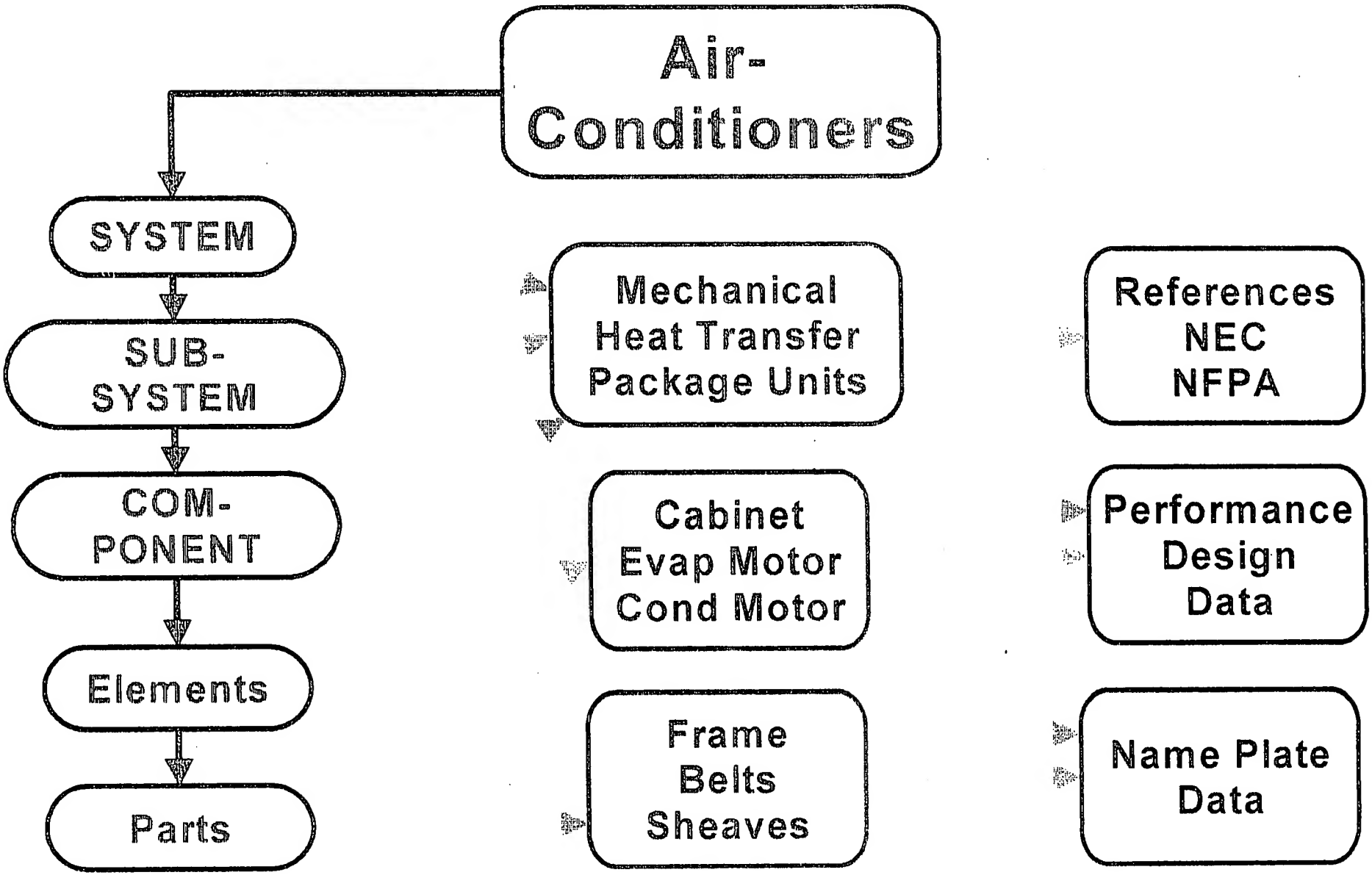
Target Task Definitions



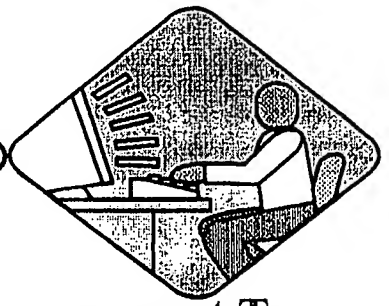
Work Target Definition



Target Design Data Definition



Work Force Optimization Through Specification The "MasterLink"



Management Team

Work Specifications

JobState Definitions

Target Definitions

Task Definitions

Job Mgmt Rules

Planning Rules

Scheduling Rules

Dispatching Rules

Job Manager Agent

Planner Agent

Scheduler Agent

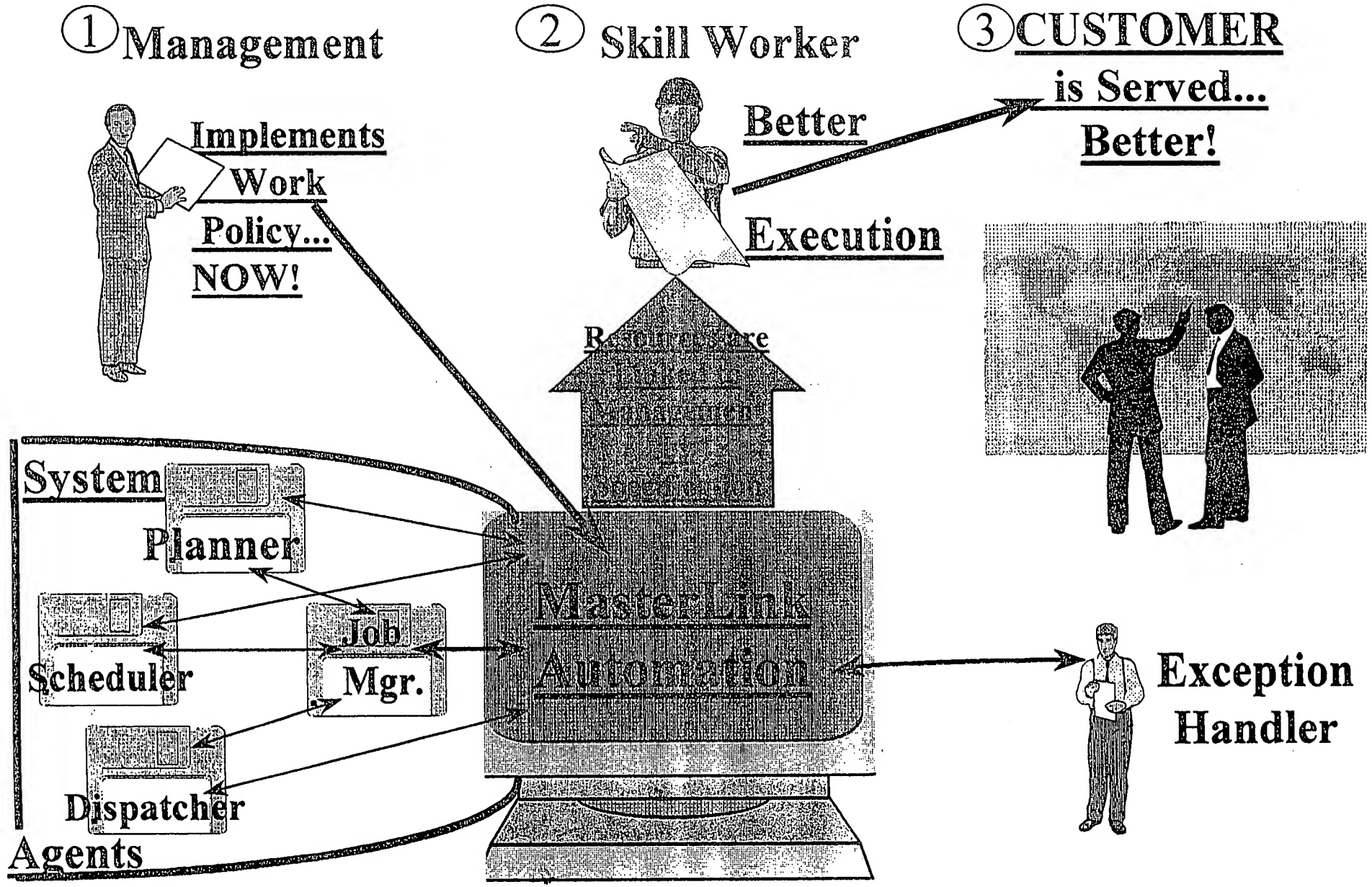
Dispatcher Agent

Jobs

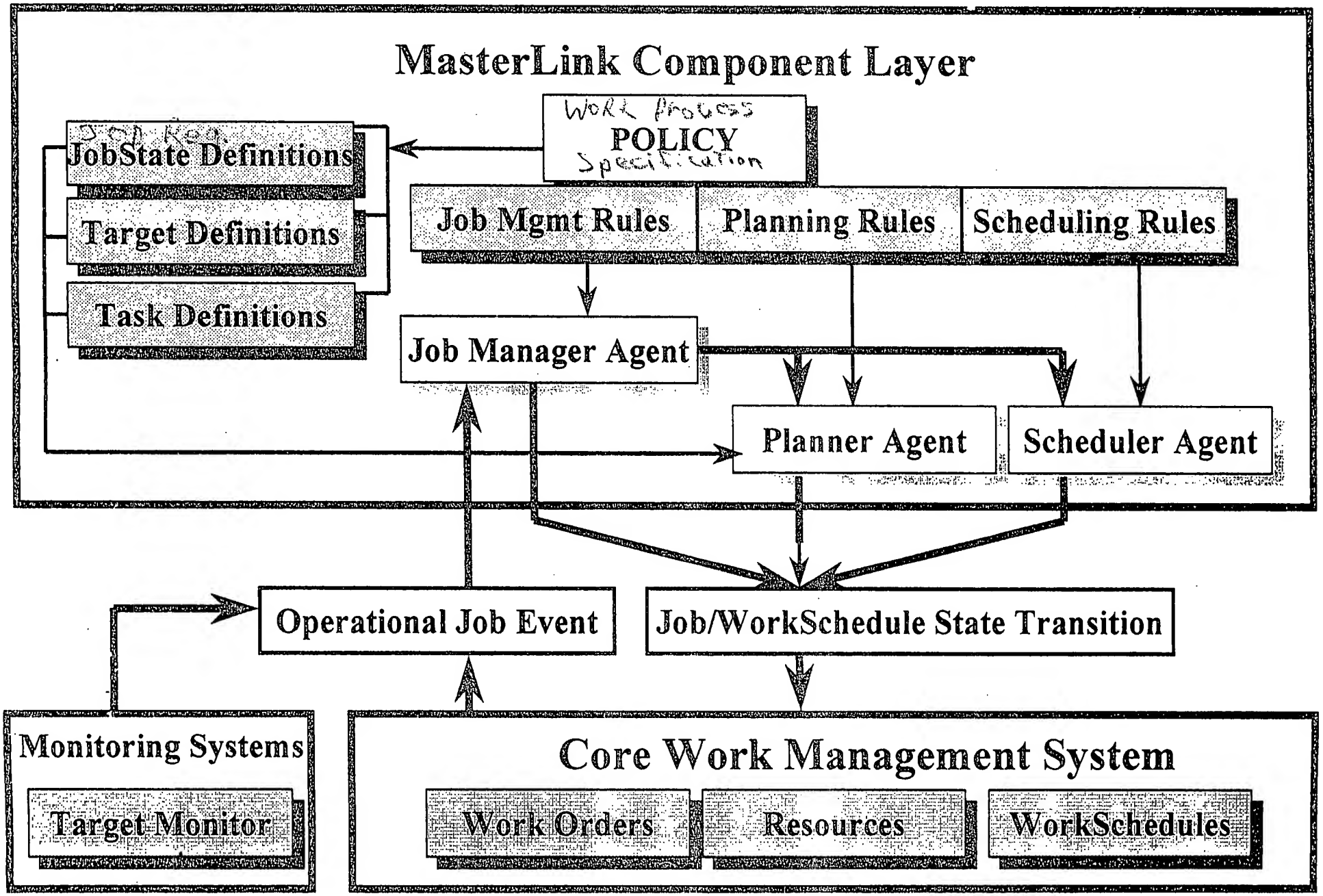
Resources

WorkSchedules

Knowledge-based Specification Implementation

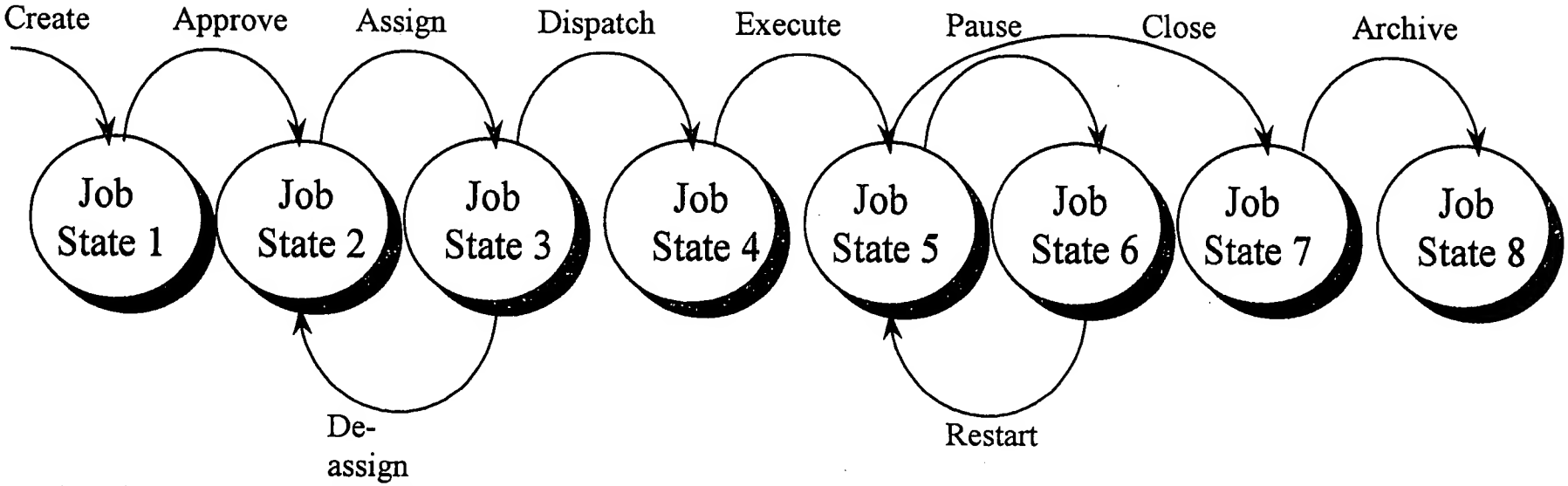


System Architecture Overview



JOB STATE TRANSITIONS

Example Job Type



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- "Job Manager" agent will act as a communications traffic cop receiving messages, representing events, from the external interfaces (either GUI or system based) , from the internal system agents, and from other MasterLink internal classes.

Subject: MasterLink possibilities
Date: Mon, 14 Jul 1997 09:31 -0500 (EST)
From: Randy_Dougherty@ccmail.orl.lmco.com
To: atek@GDI.net

Garry,
Thank you for sharing your concepts for MasterLink work automation. As I stated in our meeting, the concepts which you presented to me have some very interesting possibilities for several upcoming projects that I am involved with for Lockheed Martin Information Systems. We are evaluating products which will assist in the maintenance of Lockheed Martin end-item products (aircraft, avionics end-items, etc). When you are able to advance your MasterLink concept beyond the initial requirements stage and provide an initial prototype, I am very interested in seeing how your concept is converted to a implementation prototype. The potential for Lockheed Martin Information Systems to utilize MasterLink to automate our maintenance management systems processing is very exciting to me.

Again, thank you for your briefing and please keep in touch as your prototype is developed.

Randy Dougherty
407.306.4812

LOCKHEED MARTIN

Randy Dougherty
Manager, Logistics Info Systems

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email: randy_dougherty@ccmail.orl.lmco.com

Betty
3CC-403/